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(12) **Patent Application:** (11) **CA 2197485**

(54) WET-RESILIENT WEBS AND DISPOSABLE ARTICLES MADE THEREWITH

(54) FEUILLES DOTEES DE RESILIENCE A L'ETAT HUMIDE ET ARTICLES JETABLES QU'ON EN FAIT

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|---|---|---|
| 08/614,420 | United States | Mar. 8 , 1996 |

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Language of filing: **English**

ABSTRACT:

Paper sheets useful for tissues, paper towels, napkins, disposable absorbent products and the like can be made to exhibit a high degree of wet resiliency. This property is achieved by using a combination of high yield pulp fibers (such as bleached chemithermomechanical pulp fibers) and a wet strength agent in an uncreped throughdrying process. The resulting product, when wetted, can spring back after being crumpled in one's hand.

Abstract of the Disclosure

Paper sheets useful for tissues, paper towels, napkins, disposable absorbent products and the like can be made to exhibit a high degree of wet resiliency. This property is achieved by using a combination of high yield pulp fibers (such as bleached chemithermomechanical pulp fibers) and a wet strength agent in an uncreped throughdrying process. The resulting product, when wetted, can spring back after being crumpled in one's hand.

We claim:

1. A low-density, noncompressively-dried, three-dimensional web comprising at least about 15 dry weight percent high yield pulp fibers to which a wet strength agent has been added, said web having a density of about 0.3 grams per cubic centimeter or less, an Overall Surface Depth of about 0.2 millimeter or greater, an In-Plane Permeability of about $5x10^{-11}$ square meters or greater and a Wet Compressed Bulk of about 6 cubic centimeters per gram or greater.

2. An uncreped through-air-dried web comprising at least about 10 dry weight percent virgin high yield pulp fibers to which a wet strength agent has been added, said web having a density of about 0.15 gram per cubic centimeter or less, a Wet Compressed Bulk of about 6 cubic centimeters per gram or greater and an Overall Surface Depth of about 0.3 millimeter or greater.

3. A cellulosic web having a density of about 0.3 gram per cubic centimeter or less, a wet:dry ratio of about 0.10 or greater, an Overall Surface Depth of about 0.2 millimeter or greater, and a Wet Compressed Bulk of about 7 cubic centimeters per gram or greater.

4. The web of Claim 1 or 2 comprising at least about 30 dry weight percent high yield pulp fibers.

5. The web of Claim 1 or 2 comprising at least about 50 dry weight percent high yield pulp fibers.

6. The web of Claim 1 or 2 comprising about 100 dry weight percent high yield pulp fibers.

7. The web of Claim 1 or 2 wherein the high yield pulp fibers are bleached chemithermomechanical pulp fibers.

8. The web of Claim 1 or 2 comprising at least about 70 dry weight percent wood pulp fibers.

9. The web of Claim 1 or 2 comprising at least about 70 dry weight percent softwood fibers.

10. The web of Claim 1 or 2 wherein at least about 0.2 dry weight percent of a wet strength agent has been added.

11. The web of Claim 1 or 2 wherein from about 0.1 to about 3 dry weight percent of a wet strength agent has been added.

12. The web of Claim 1 or 2 or 3 having a basis weight of from about 10 to about 80 grams per square meter.

13. The web of Claim 1 or 2 or 3 having a basis weight of from about 20 to about 60 grams per square meter.

14. The web of Claim 1 or 2 or 3 having a density of about 0.1 gram per cubic centimeter or less.

15. The web of Claim 1 or 2 or 3 having a Wet Wrinkle Recovery of about 60 percent or greater.

16. The web of Claim 1 or 2 or 3 having a Wet Wrinkle Recovery of about 70 percent or greater.

17. The web of Claim 1 or 2 or 3 having a Wet Wrinkle Recovery of about 80 percent or greater.

18. The web of Claim 1 or 2 or 3 having a wet:dry ratio of about 0.2 or greater.

19. The web of Claim 1 or 2 or 3 having a wet:dry ratio of about 0.5 or greater.

20. The web of Claim 1 or 2 or 3 having a Compression Ratio of from 0.4 to about 0.7.

21. The web of Claim 1 or 2 or 3 having a Wet Springback Ratio of about 0.75 or greater.

22. The web of Claim 1 or 2 or 3 having a Wet Springback Ratio of about 0.9 or greater.

23. The web of Claim 1 or 2 or 3 having a Wet Springback Ratio of from about 0.8 to about 0.93.

24. The web of Claim 1 or 2 or 3 having a Loading Energy Ratio of about 0.7 or greater.

25. The web of Claim 1 or 2 or 3 having a Loading Energy Ratio of about 0.8 or greater.

26. The web of Claim 1 or 2 or 3 having a Loading Energy Ratio of from about 0.7 to about 0.9.

27. The web of Claim 1 or 2 or 3 having a Wet Compressed Bulk of about 7 cubic centimeters per gram or greater.

28. The web of Claim 1 or 2 or 3 having a Wet Compressed Bulk of about 8 cubic centimeters per gram or greater.

29. The web of Claim 1 or 2 or 3 having a Wet Compressed Bulk of from about 8 to about 13 cubic centimeters.

30. The web of Claim 1 or 2 or 3 having a Wet Compressed Bulk of about 8 cubic centimeters per gram or greater, a Wet Springback ratio of about 0.8 or greater and a Loading Energy Ratio of about 0.7 or greater.

31. The web of Claim 1 or 2 or 3 wherein the fibers of the web have a water retention value of about 0.9 or greater.

32. The web of Claim 1 or 2 or 3 having an In-Plane Permeability of about $5x10^{-11}$ square meters or greater.

33. The web of Claim 1 or 2 or 3 having an In-Plane Permeability of from about $5x10^{-11}$ to about $80x10^{-11}$ square meters.

34. The web of Claim 1 or 2 or 3 having an In-Plane Permeability of from about $8x10^{-11}$ to about $30x10^{-11}$ square meters.

35. The web of Claim 1 or 2 or 3 having a FIFE Test value of about 125 seconds or less.

36. The web of Claim 1 or 2 or 3 having a FIFE Test value of about 75 seconds or less.

37. The web of Claim 1 or 2 or 3 having a Dry Wipe Residue Total Area coverage of about 2000 square millimeters or less.

38. The web of Claim 1 or 2 or 3 having a Dry Wipe Residue Mass Factor of about 30 or less.

39. The web of Claim 1 or 2 or 3 having a Wet Wipe Residue Total Area coverage of about 1500 square millimeters or less.

40. The web of Claim 1 or 2 or 3 having a Wet Wipe Residue Mass Factor of about 5 or less.

41. The web of Claim 1 or 2 or 3 having a Mean Volume-Weighted Pore Length of about 550 microns or greater.

42. The web of Claim 1 or 2 or 3 having a Thickness Variation Index of about 25 percent or less.

43. The web of Claim 1 or 2 or 3 having an Overall Surface Depth of from about 0.4 to about 0.8 millimeters.

44. The web of Claim 1 which has been through-air-dried.

45. An absorbent article comprising the web of Claim 1 or 2 or 3.

46. A disposable diaper comprising the web of Claim 1 or 2 or 3.

47. A feminine pad comprising the web of Claim 1 or 2 or 3.

48. A meat and poultry pad comprising the web of Claim 1 or 2 or 3.

49. A bed pad comprising the web of Claim 1 or 2 or 3.

50. An absorbent article comprising a backsheet layer, a liquid permeable topsheet layer connected in a superposed relation with said backsheet layer, and at least one through-air-dried sheet sandwiched between said topsheet layer and backsheet layer, said through-air-dried sheet comprising at least about 20 dry weight percent high yield pulp fibers to which a wet strength agent has been added and having a density of about 0.3 grams per cubic centimeter or less, an Overall Surface Depth of about 0.3 millimeters or greater and a Wet Compressed Bulk of about 7 cubic centimeters per gram or greater.

51. The absorbent article of Claim 50 wherein the through-air-dried sheet has a Wet Compressed Bulk of about 7 cubic centimeters per gram or greater.

52. The absorbent article of Claim 50 wherein the through-air-dried sheet has a FIFE Test value of about 125 seconds or less.

53. The absorbent article of Claim 50 wherein the through-air-dried sheet has an In-Plane Permeability of about $4 \times 10^{-11}$ or greater.

54. The absorbent article of Claim 50 further comprising an absorbent fluff batt of fibers adjacent the through-air-dried sheet.

55. The absorbent article of Claim 50 having from 2 to about 20 through-air-dried sheets.

56. The absorbent article of Claim 50 wherein the through-air-dried sheet is uncreped.

57. An absorbent article comprising a cellulosic web having a density of about 0.3 gram per cubic centimeter or less, a wet:dry ratio of about 0.1 or greater, an Overall Surface Depth of about 0.2 millimeter or greater, a Wet Compressed Bulk of 7 cubic centimeters per gram or greater, a Wet Springback Ratio of about 0.75 or greater, a FIFE Test value of 125 seconds or less, and an In-Plane Permeability of about $4x10^{-11}$ square meters or greater.

58. An absorbent article comprising a backsheet layer, a liquid permeable topsheet layer connected in a superposed relation with said backsheet layer, and a retention portion for storing liquid, said retention portion sandwiched between said topsheet layer and backsheet layer and including at least one uncreped through-air-dried sheet having a density of about 0.3 grams per cubic centimeter or less, a FIFE Test value of about 100 seconds or less, and an Overall Surface Depth of about 0.3 millimeter or greater, said sheet comprising at least about 20 dry weight percent high yield pulp fibers to which a wet strength agent has been added.

59. The absorbent article of Claim 58 wherein said retention portion comprises a pair of said uncreped through-air-dried sheets with high absorbency materials disposed between said sheets.

60. The absorbent article of Claim 59 further comprising a liquid acquisition/distribution layer disposed between said topsheet layer and said sheets and a support layer disposed between said sheets and said backsheet layer.

61. The absorbent article of Claim 60 wherein said support layer comprises a compressed layer of wood pulp fluff.

62. The absorbent article of Claim 58 wherein said sheet is folded to form an envelope and high-absorbency materials are disposed within said envelope.

63. The absorbent article of Claim 58 wherein said sheet has a Wet Compressed Bulk of about 8 cubic centimeters per gram.

64. An absorbent article comprising a backsheet layer, a liquid permeable topsheet layer connected in a superposed relation with said backsheet layer, and an absorbent structure sandwiched between said topsheet layer and backsheet layer, said absorbent structure including a retention portion for storing said liquid, and a surge portion for managing a distribution of said liquid, said surge portion including at least one uncreped through-air-dried sheet having a density of about 0.3 grams per cubic centimeter or less, an Overall Surface Depth of about 0.3 millimeters or greater, and an In-Plane Permeability of about $5x10^{-11}$ square meters or greater.

65. An article as recited in Claim 64, wherein said surge portion manages a distribution of said liquid.

66. An article as recited in Claim 64, wherein said surge portion manages an acquisition of said liquid.

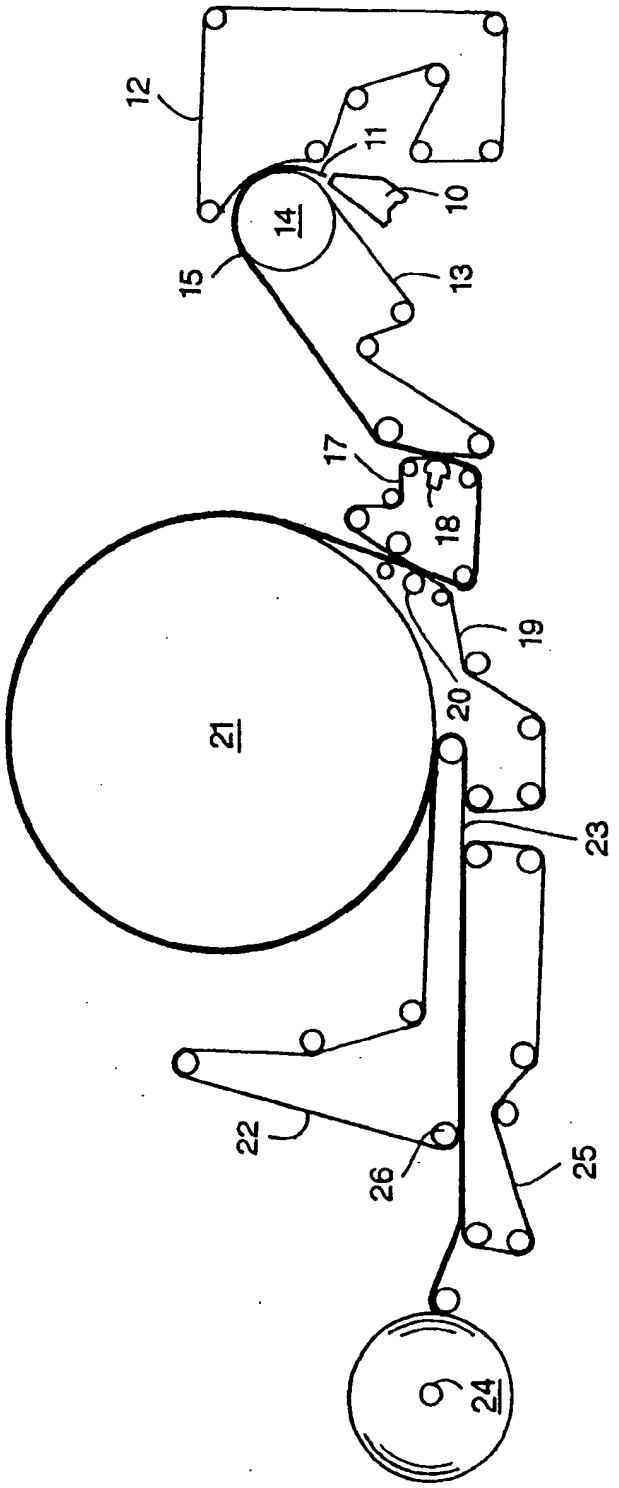


FIG. 1

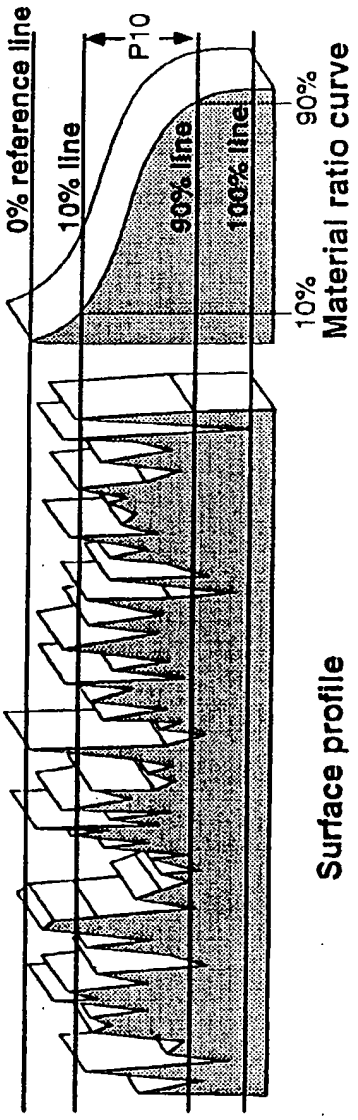
0% reference line
10% line
P10
90% line
100% line
90%
10%
Material ratio curve
Surface profile

FIG. 2

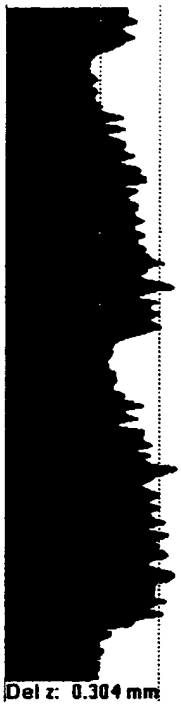


FIG. 3A


FIG. 3B

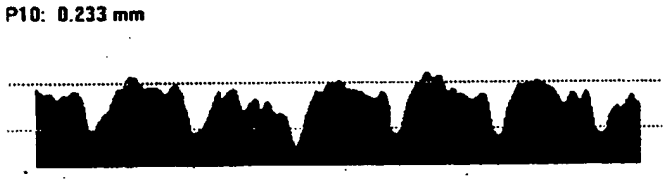


FIG. 3C

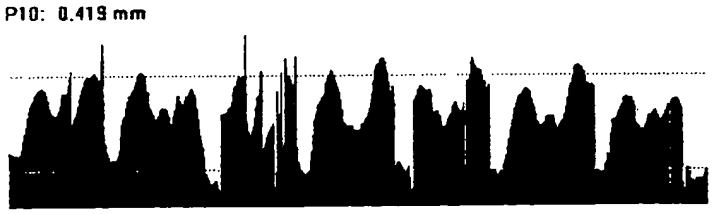


FIG. 4A

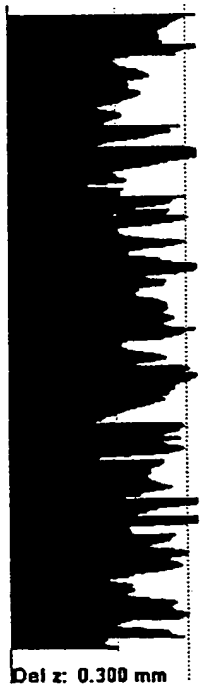


FIG. 4B

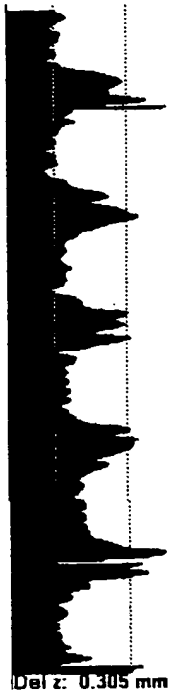


FIG. 4C

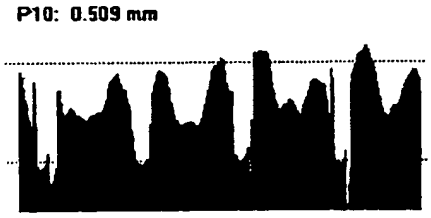


FIG. 5

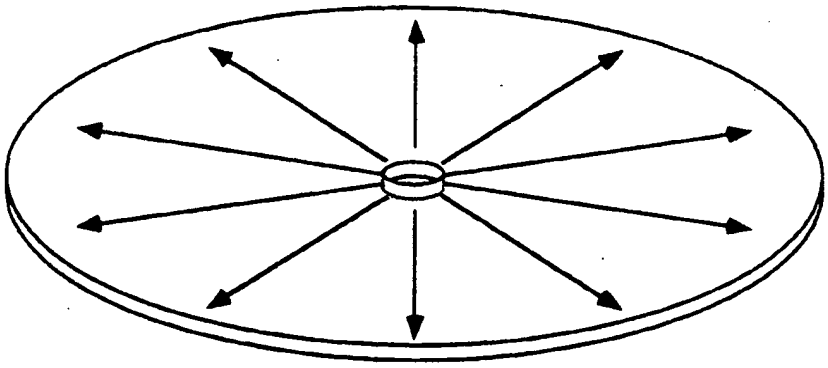

FIG. 6

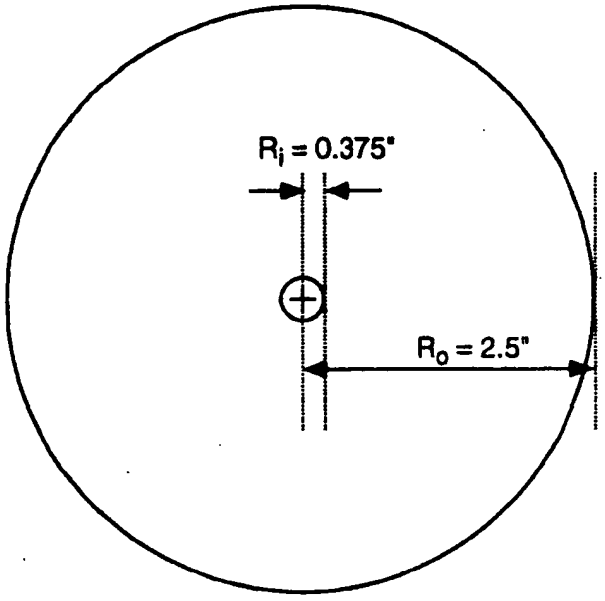


FIG. 7

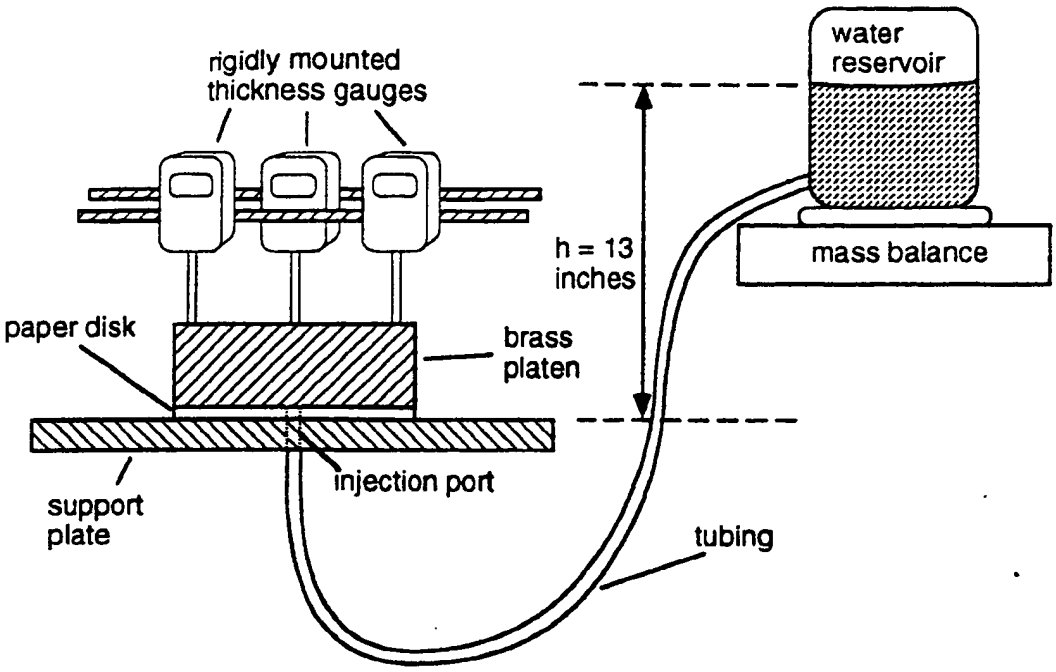
rigidly mounted
thickness gauges
water
reservoir
h = 13
inches
mass balance
paper disk
brass
platen
support
plate
injection port
tubing

FIG. 8

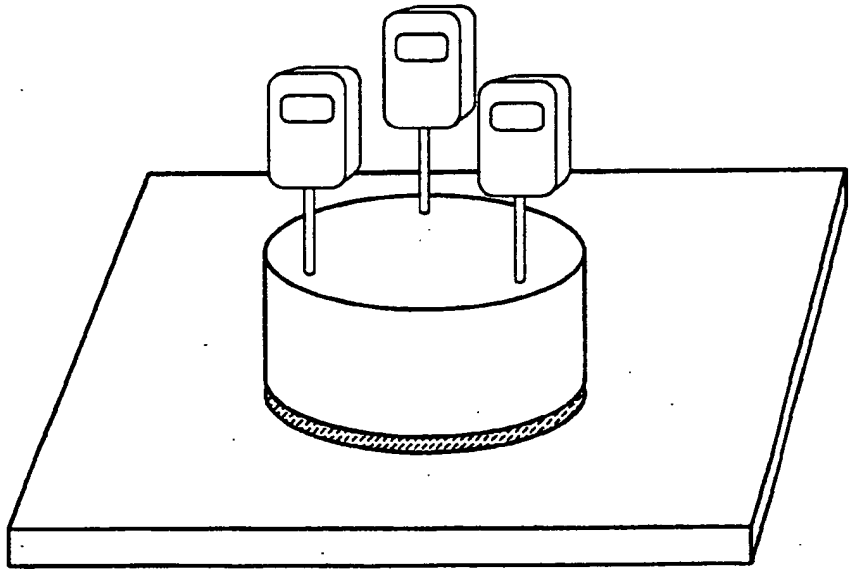

FIG. 9

| Present invention sample numbers | Fiber | BW (single ply) | Kymene, lb/ton of fiber | Fabric type | Rush transfer, % |
|---|---|---|---|---|---|
| U1 | Spruce BCTMP | 30 | 20 | T116-3 | 15 |
| U2 | Spruce BCTMP | 60 | 20 | T116-3 | 30 |
| U3 | Spruce BCTMP | 40 | 10 | T 116-3 | 35 |
| U4 | Spruce BCTMP | 40 | 20 | T 116-3 | 35 |
| U5 | Spruce BCTMP | 60 | 10 | T 116-3 | 35 |
| U6 | Spruce BCTMP | 60 | 20 | T 116-3 | 35 |
| U7 | Spruce BCTMP | 60 | 10 | T 116-3 | 15 |
| U8 | 25% Spruce BCTMP, 75% north. SW kraft | 60 | 10 | T 116-3 | 15 |
| U9 | Spruce BCTMP | 60 | 10 | T 116-1 | 15 |
| U10 | Spruce BCTMP | 40 | 30 | T 116-3 | ? |

FIG. 10

| Related Art Materials | BW, gsm | Sheets | MR | Initial bulk, cc/g | Comp. bulk, cc/g | Final bulk, cc/g | Spring-back | LER |
|---|---|---|---|---|---|---|---|---|
| Viva Ultra | 62 | 2 | 1.00 | 13.0 | 4.3 | 6.7 | 0.515 | 0.475 |
| Brawny, 1994 | 47 | 3 | 1.26 | 12.2 | 3.7 | 7.5 | 0.614 | 0.635 |
| Bounty Quilted | 38 | 2 | 1.25 | 21.4 | 5.8 | 14.1 | 0.657 | 0.623 |
| Bounty Quilted | 39 | 3 | 1.18 | 20.7 | 5.6 | 13.8 | 0.667 | 0.626 |
| Printed Bounty | 60 | 2 | 1.09 | 21.6 | 5.5 | 13.0 | 0.604 | 0.604 |
| Air-laid Softwood | 129 | 1 | 0.93 | 27.5 | 6.3 | 11.5 | 0.417 | 0.494 |
| **Other Uncreped Materials** | | | | | | | | |
| Surpass | 41 | 3 | 1.27 | 11.6 | 5.2 | 9.2 | 0.793 | 0.720 |
| Surpass | 40 | 3 | 1.08 | 12.0 | 5.3 | 9.6 | 0.797 | 0.673 |
| Surpass | 41 | 3 | 1.13 | 11.5 | 5.2 | 9.1 | 0.793 | 0.720 |
| O2 | 38 | 3 | 1.22 | 13.5 | 5.8 | 10.3 | 0.762 | 0.623 |
| O3 | 60 | 2 | 1.12 | 12.9 | 6.8 | 10.6 | 0.825 | 0.658 |
| O4 | 59 | 2 | 1.09 | 10.2 | 5.2 | 8.1 | 0.796 | 0.664 |
| **Present Invention** | | | | | | | | |
| U2 | 57 | 2 | 1.21 | 15.2 | 8.7 | 14.1 | 0.929 | 0.835 |
| U3 | 39 | 3 | 1.58 | 23.1 | 9.6 | 18.3 | 0.793 | 0.713 |
| U3 | 40 | 3 | 1.18 | 22.6 | 9.7 | 18.0 | 0.798 | 0.716 |
| U4 | 40 | 3 | 1.33 | 21.8 | 9.7 | 18.0 | 0.829 | 0.740 |
| U5 | 55 | 2 | 1.16 | 16.7 | 9.4 | 14.7 | 0.880 | 0.807 |
| U5 | 58 | 2 | 1.18 | 15.3 | 9.2 | 13.8 | 0.903 | 0.793 |
| U6 | 58 | 2 | 1.24 | 16.2 | 9.7 | 14.3 | 0.883 | 0.814 |
| U6 | 58 | 2 | 1.34 | 16.3 | 9.6 | 14.5 | 0.895 | 0.833 |
| U7 | 59 | 2 | 1.08 | 14.9 | 8.3 | 12.8 | 0.861 | 0.797 |
| U7 | 58 | 2 | 1.19 | 16.0 | 8.0 | 13.5 | 0.842 | 0.768 |
| U8 | 58 | 2 | 1.16 | 13.2 | 7.5 | 11.1 | 0.839 | 0.718 |
| U9 | 59 | 2 | 1.12 | 13.1 | 7.3 | 11.7 | 0.889 | 0.761 |
| U10 | 37 | 3 | 1.16 | 24.2 | 11.6 | 20.2 | 0.835 | 0.755 |
| U10 | 38 | 3 | 1.22 | 23.6 | 10.9 | 19.1 | 0.809 | 0.735 |

FIG. 11

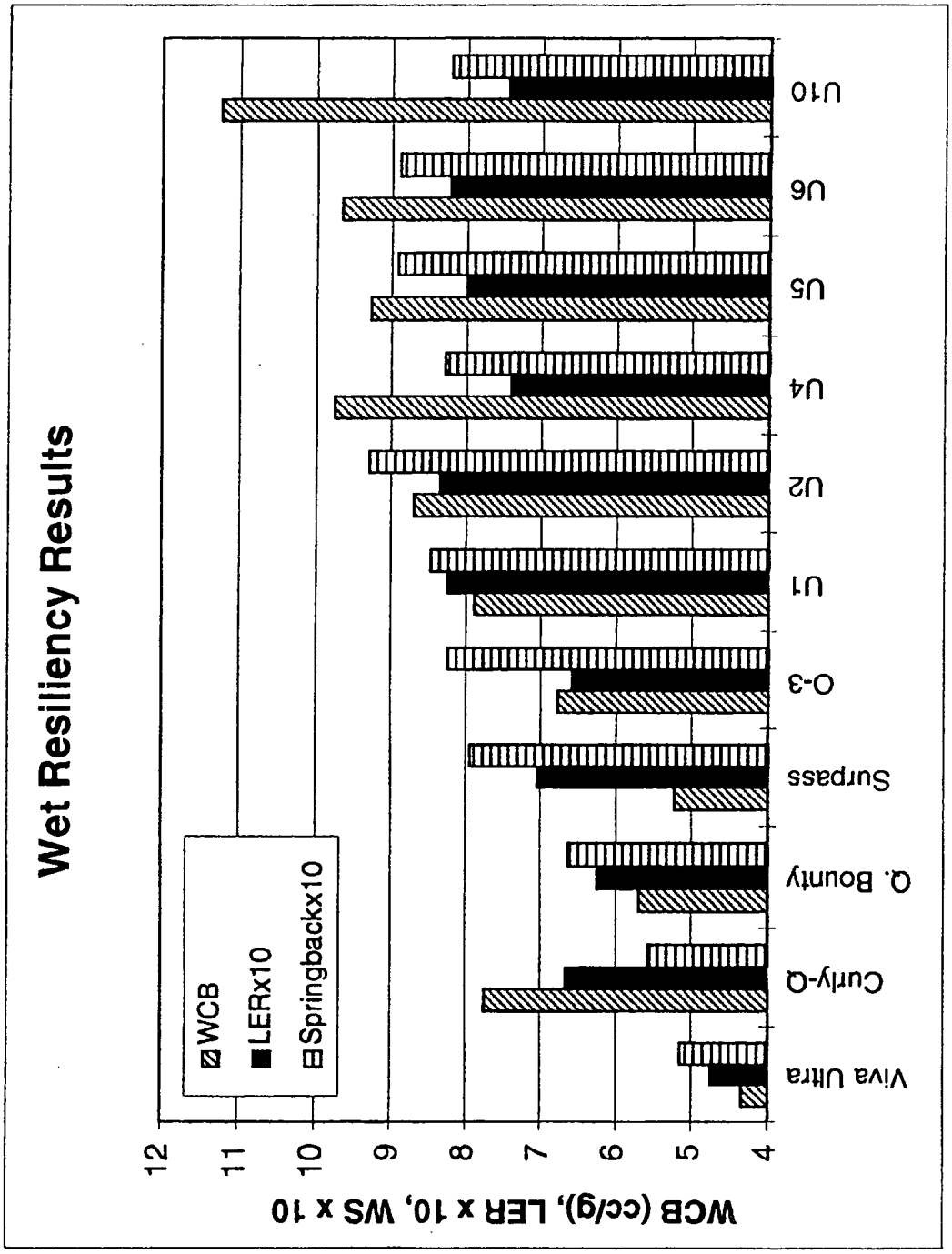
Wet Resiliency Results
WCB (cc/g), LER x 10, WS x 10
12
11
10
9
8
7
6
5
4
WCB
LERx10
Springbackx10
Viva Ultra
Curly-Q
Q. Bounty
Surpass
O-3
U1
U2
U4
U5
U6
U10

FIG. 12

| Sample | Dry BW, gsm | Wet weight, g | Oven dry weight, g | Moisture ratio | Initial thickness @ 0.025 psi | Thickness at 2 psi, in | Final thickness, in | Initial bulk, cc/g | Wet Comp. Bulk, cc/g | Final bulk, cc/g | Spring-back | LER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CQ-A | 155 | 1.34 | 0.644 | 1.08 | 0.226 | 0.051 | 0.115 | 35.9 | 8.11 | 18.3 | 0.509 | 0.64 |
| CQ-A2 | 153 | 1.39 | 0.637 | 1.18 | 0.176 | 0.046 | 0.109 | 28.3 | 7.40 | 17.5 | 0.619 | 0.723 |
| CQ-A3 | 150 | 1.24 | 0.625 | 0.98 | 0.159 | 0.043 | 0.099 | 26.1 | 7.05 | 16.2 | 0.623 | 0.736 |
| CQ-B | 107 | 1.02 | 0.445 | 1.29 | 0.15 | 0.036 | 0.081 | 34.5 | 8.29 | 18.6 | 0.54 | 0.641 |
| CQ-C | 184 | 1.565 | 0.766 | 1.04 | 0.277 | 0.059 | 0.140 | 37.0 | 7.89 | 18.7 | 0.505 | 0.634 |
| CQ-D | 214 | 1.98 | 0.891 | 1.22 | 0.342 | 0.067 | 0.174 | 39.3 | 7.70 | 20.0 | 0.509 | 0.599 |
| CQ-E | 201 | 1.82 | 0.835 | 1.18 | 0.285 | 0.064 | 0.146 | 35.0 | 7.85 | 17.9 | 0.512 | 0.636 |
| CQ-F | 87 | 0.741 | 0.361 | 1.05 | 0.101 | 0.027 | 0.065 | 28.7 | 7.66 | 18.5 | 0.644 | 0.713 |
| HBAFF-1 | 121 | 1.057 | 0.502 | 1.11 | 0.168 | 0.033 | 0.073 | 34.3 | 6.73 | 14.9 | 0.435 | 0.566 |
| HBAFF-2 | 94 | 0.866 | 0.392 | 1.21 | 0.141 | 0.025 | 0.062 | 36.8 | 6.53 | 16.2 | 0.44 | 0.599 |
| HPZ | 95 | 0.853 | 0.397 | 1.15 | 0.113 | 0.022 | 0.052 | 29.2 | 5.68 | 13.4 | 0.46 | 0.565 |

FIG. 13

219/417

| Present invention sample numbers | Fiber | BW (single ply) | Sheets or layers used | Kymene, lb/ton of fiber | Fabric type | Rush transfer, % | In-plane permeab., $m^2 \times 10^{10}$ | Wet bulk at 0.8 psi, cc/g |
|---|---|---|---|---|---|---|---|---|
| U3 | Spruce BCTMP | 40 | 2 | 10 | T 116-3 | 35 | 1.05 | 10.31 |
| U4 | Spruce BCTMP | 40 | 2 | 20 | T 116-3 | 35 | 1.19 | 10.99 |
| U4b | Spruce BCTMP | 40 | 2 | 20 | T 116-3 | 35 | 1.56 | 11.79 |
| U4c | Spruce BCTMP | 40 | 3 | 20 | T 116-3 | 35 | 1.22 | 11.46 |
| U4d | Spruce BCTMP | 40 | 4 | 20 | T 116-3 | 35 | 1.05 | 11.20 |
| U5 | Spruce BCTMP | 60 | 2 | 10 | T 116-3 | 35 | 1.26 | 9.89 |
| U6 | Spruce BCTMP | 60 | 2 | 20 | T 116-3 | 35 | 1.87 | 10.53 |
| U7 | Spruce BCTMP | 60 | 2 | 10 | T 116-3 | 15 | 0.55 | 8.46 |
| U8 | 25% Spruce BCTMP, 75% north. SW kraft | 60 | 2 | 10 | T 116-3 | 15 | 0.84 | 7.99 |
| U9 | Spruce BCTMP | 60 | 2 | 10 | T 116-1 | 15 | 0.60 | 7.74 |
| Other samples | | | | | | | | |
| P1 | Surpass towel | 40 | 2 | | | | 0.41 | 5.43 |
| P2 | Quilted Bounty | 40 | 2 | | | | 0.34 | 5.70 |
| P3 | HBAFF air-laid pad | 229 | 1 | | | | 0.30 | 7.71 |
| P4 | Curly-Q fiber, air-laid | 245 | 1 | | | | 0.43 | 8.87 |
| P5 | Birch BCTMP UCTAD | 60 | 1 | 0 | | | 0.05 | 5.79 |
| P6 | Untreated softwood fluff | 179 | 2 | | | | 0.03 | 6.59 |
| P7 | Air-laid CR-1654 | 206 | 1 | | | | 0.043 | 6.74 |

FIG. 14

| Code | Insult 1 time, sec | Insult 2 time, sec | Insult 3 time, sec | **Sum of insult times** | Dry weight |
|---|---|---|---|---|---|
| Surpass | 35. | 215.9 | 358.1 | **609.** | 9.3 |
| Bounty | 10.3 | 26.8 | 117.4 | **155.** | 8.83 |
| U3 | 4.3 | 6.9 | 13.5 | **25.** | 10.77 |
| U4 | 7.0 | 6.7 | 11.2 | **25.** | 10.46 |
| U5 | 9.5 | 16.9 | 24.5 | **51.** | 10.45 |
| U6 | 11.4 | 15.3 | 21.8 | **49.** | 10.62 |
| U7 | 11.4 | 24.7 | 50.4 | **86.** | 10.72 |
| U8 | 12.7 | 26.1 | 53.7 | 92. | 10.24 |

FIG. 15

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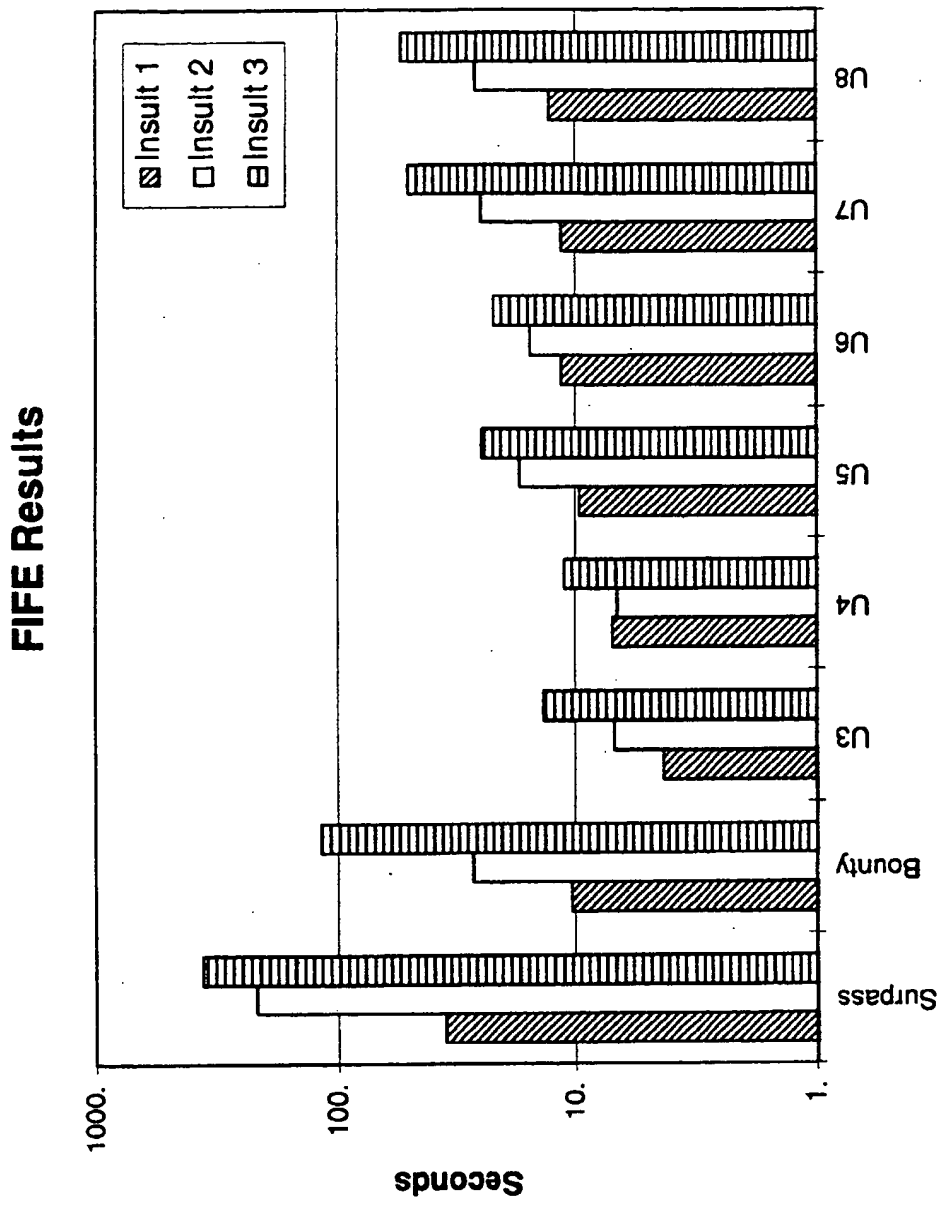
FIFE Results
Insult 1
Insult 2
Insult 3
1000.
100.
10.
1.
Seconds
Surpass
Bounty
U3
U4
U5
U6
U7
U8
Sample

FIG. 16

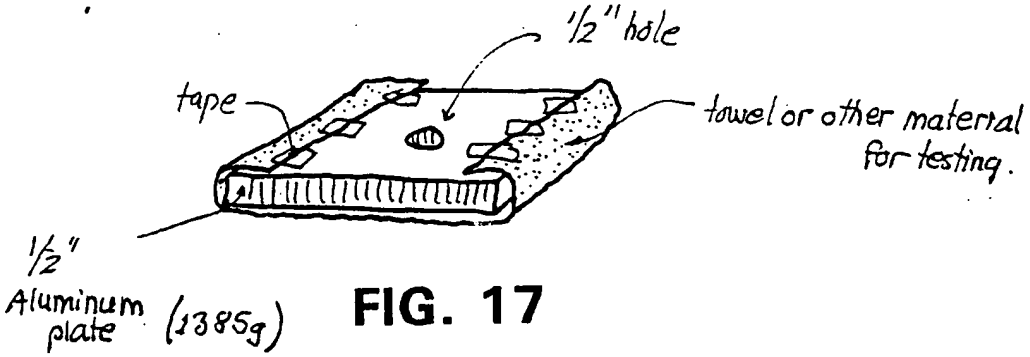


FIG. 17

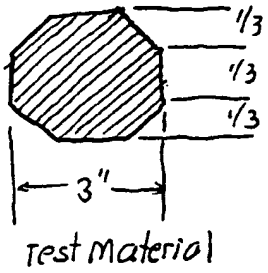


FIG. 18

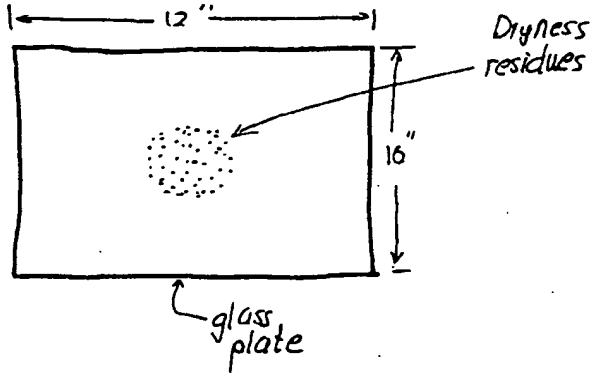


FIG. 19

Dry Wipe Residual Data

| Sample Identification | Total Area ($mm^2$) | % Coverage | Mass Factor (area*darkness/1000) |
|---|---|---|---|
| 1. Surpass | 3222 | 29.0 | 58.0 |
| 2. BOUNTY® | 3684 | 53.4 | 57.0 |
| 3. CHF, 40 gsm, 10 lb/t | 1421 | 16.6 | 17.5 |
| 4. " , " " , 20 " | 971 | 12.9 | 11.0 |
| 5. " , 60 " , 10 " | 1002 | 15.1 | 9.7 |
| 6. " , " " , 20 " | 780 | 12.2 | 8.3 |
| 7. EFU, " " , 10 " | 892 | 11.0 | 7.5 |
| 8. CHF, " " , 25/75, Spr./LL19, 10 lb/t | 708 | 10.3 | 11.0 |

FIG. 20

Wet Wipe Residual Data

| Sample Identification | Total Area ($mm^2$) | % Coverage | Mass Factor (area*darkness/1000) |
|---|---|---|---|
| 1. Surpass | 1086 | 22.0 | 8.87 |
| 2. BOUNTY® | 1815 | 35.4 | 16.4 |
| 3. CHF, 40 gsm, 10 lb/t | 581 | 12.2 | 4.06 |
| 4. " , " " , 20 " | 652 | 13.6 | 5.00 |
| 5. " , 60 " , 10 " | 419 | 8.72 | 2.76 |
| 6. " , " " , 20 " | 476 | 10.3 | 3.46 |
| 7. EFU, " " , 10 " | 657 | 13.6 | 3.28 |
| 8. CHF, " " , 25/75, Spr./LL19, 10 lb/t | 576 | 11.8 | 4.16 |

FIG. 21

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| Sample Identification | Mean Volume-Weighted Pore Length | Thickness Variation (% COV) |
|---|---|---|
| 1. Surpass | 136 | 14.9 |
| 2. BOUNTY® | 484 | 43.9 |
| 3. CHF, 40 gsm, 10 lb/t | 642 | 8.7 |
| 4. " , " " , 20 " | 930 | 17.8 |
| 5. " , 60 " , 10 " | 788 | 15.0 |
| 6. " , " " , 20 " | 849 | – |
| 7. EFU , " " , 10 " | 772 | – |
| 8. CHF, " " , 25/75, Spr./LL19,10 lb/t | 697 | 16.8 |

FIG. 22

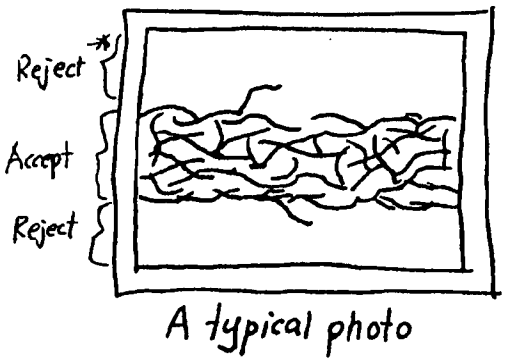


FIG. 23

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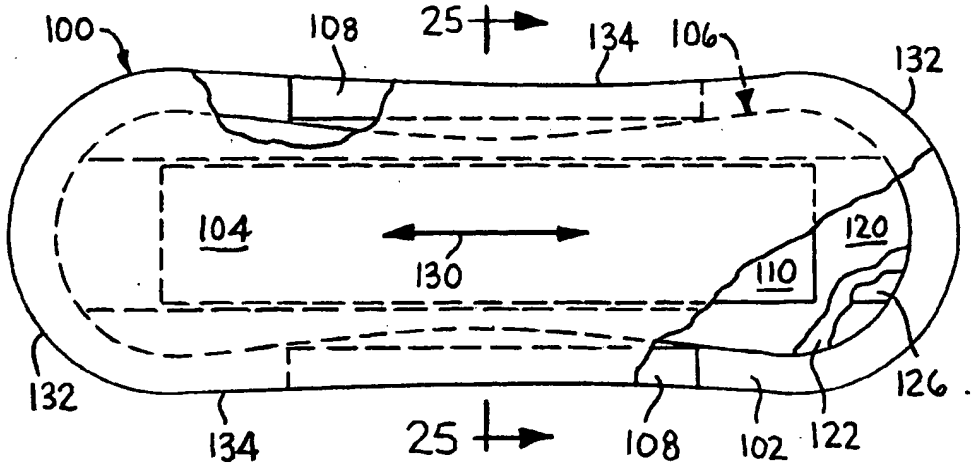
100
108
25
134
106
132
104
130
120
110
132
126
134
25
108
102
122

FIG. 24

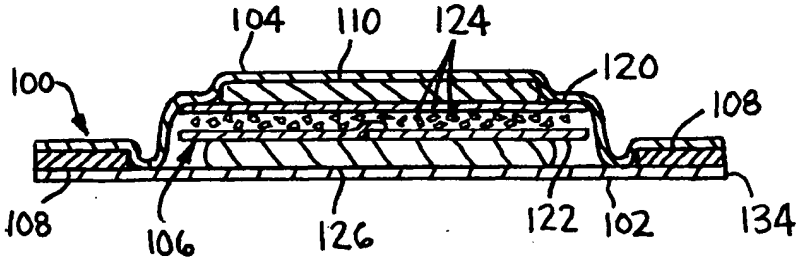
104
110
124
120
100
108
108
106
126
122
102
134

FIG. 25

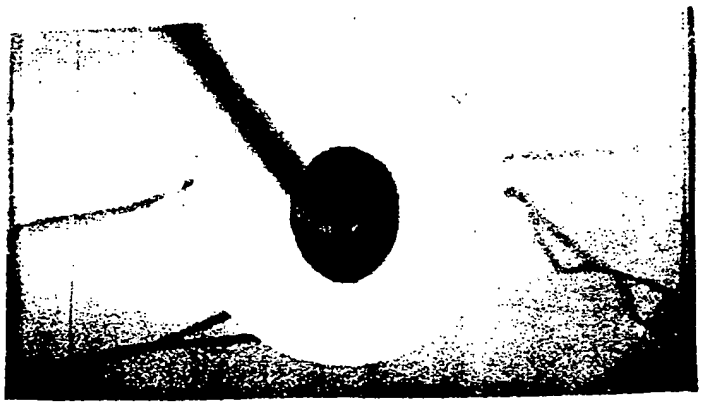

FIG. 26A

FIG. 26B

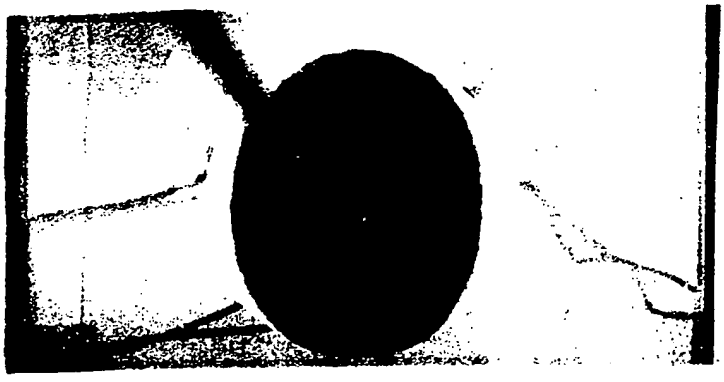

FIG. 26C

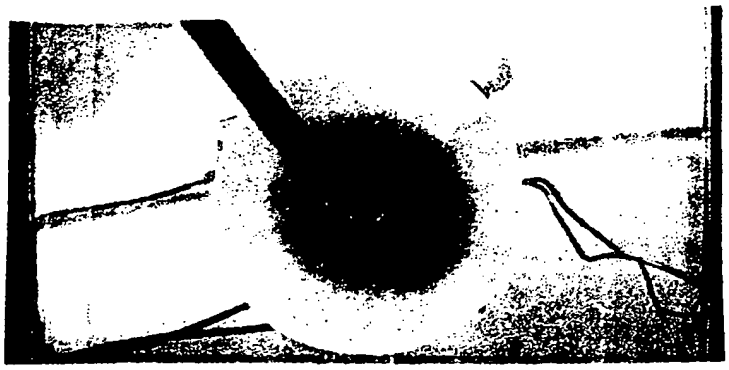

FIG. 27

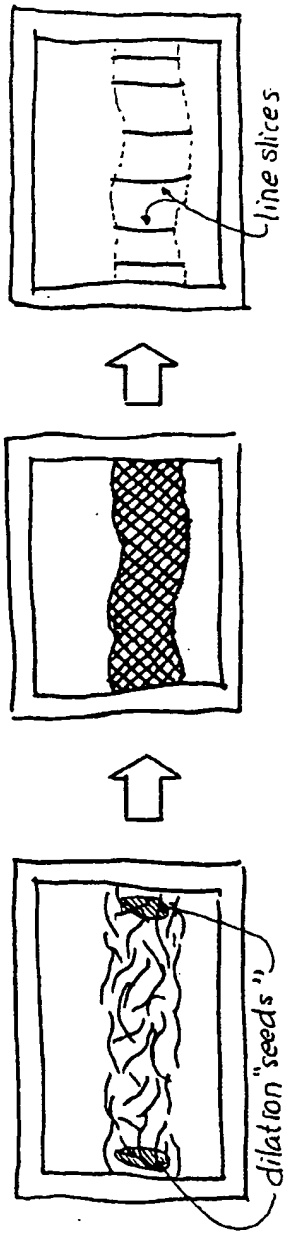


FIG. 28A

FIG. 28B

FIG. 28C